Cowshed IWI

Exterior wall
created on 13.4.2023

Thermal protection

U = 0,11 W/(m²K)

Interior insulation: No requirement*

excellent — insufficient

Moisture proofing

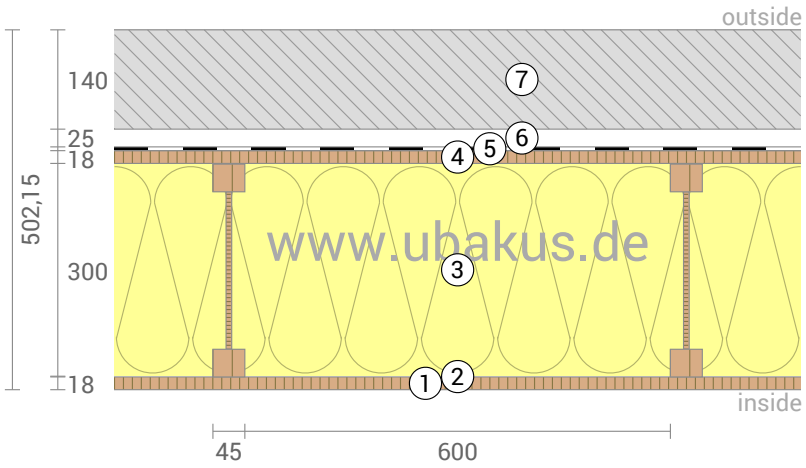
No condensate

excellent — insufficient

Heat protection

Temperature amplitude damping: 35
phase shift: 13,8 h
Thermal capacity inside: 32 kJ/m²K

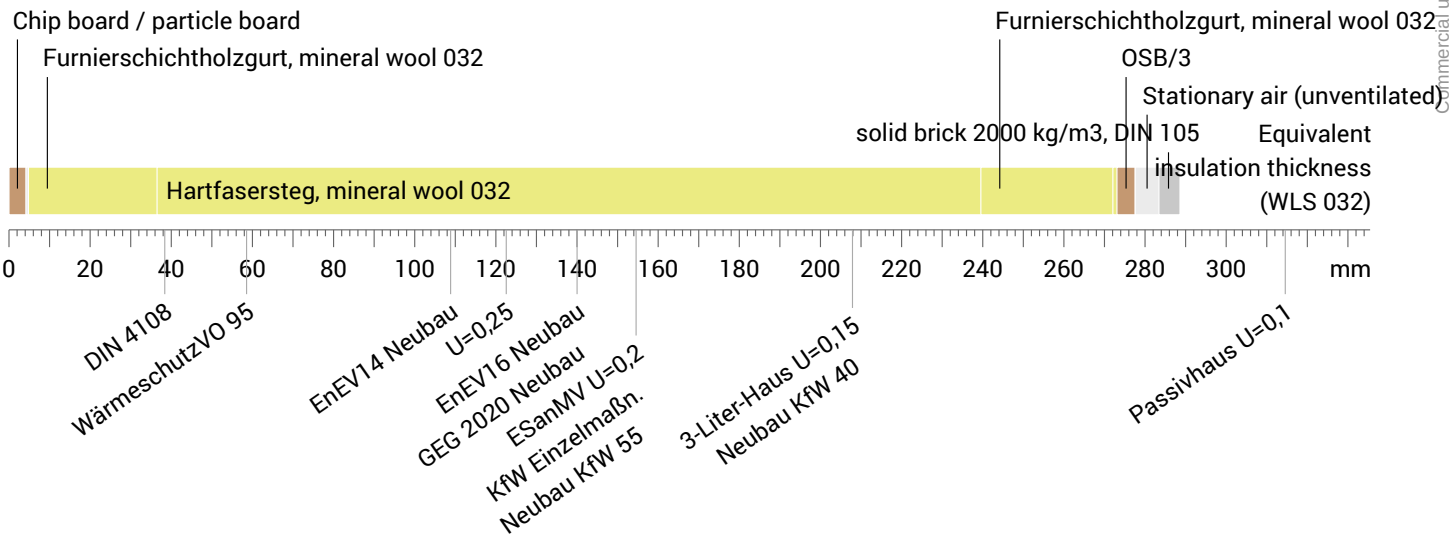
excellent — insufficient



1. Chip board / particle board (18 mm)
2. Stationary air (1 mm)
3. mineral wool 032 (300 mm)
4. OSB/3 (18 mm)
5. Tyvek® H1
6. Stationary air (25 mm)
7. solid brick 2000 kg/m3, DIN 105 (140 mm)

Impact of each layer and comparison to reference values

For the following figure, the thermal resistances of the individual layers were converted in millimeters insulation. The scale refers to an insulation of thermal conductivity 0,032 W/mK.



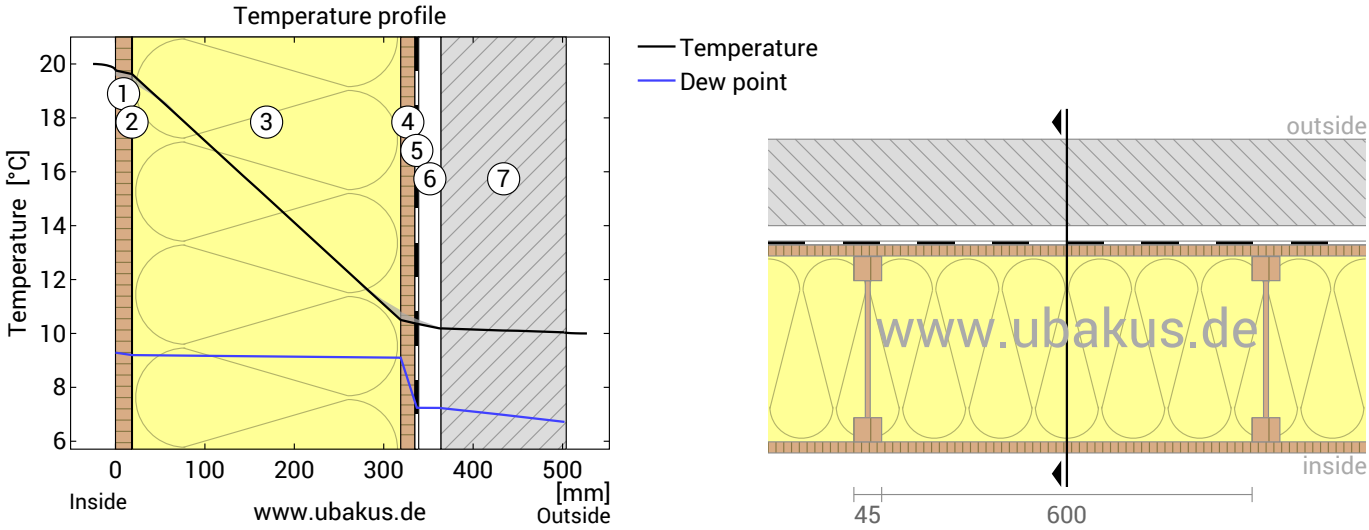
Inside air :	20,0°C / 50%			Thickness:	50,2 cm
Outside air:	10,0°C / 80%	sd-value:	7,5 m	Weight:	314 kg/m²
Surface temperature.:	19,6°C / 10,0°C			Heat capacity:	334 kJ/m²K

*Vergleich mit dem Höchstwert gemäß GEG 2020 für erstmaligen Einbau, Ersatz oder Erneuerung von Innenraumseitigen Dämmschichten (keine Anforderung).

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Cowshed IWI , U=0,11 W/(m²K)

Temperature profile



① Chip board / particle board (18 mm)
② Stationary air (1 mm)
③ mineral wool 032 (300 mm)
④ OSB/3 (18 mm)
⑤ Tyvek® H1
⑥ Stationary air (25 mm)
⑦ solid brick 2000 kg/m3, DIN 105 (...

Left: Temperature and dew-point temperature at the place marked in the right figure. The dew-point indicates the temperature, at which water vapour condensates. As long as the temperature of the component is everywhere above the dew point, no condensation occurs. If the curves have contact, condensation occurs at the corresponding position.
Right: The component, drawn to scale.

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	19,6	20,0	
1	1,8 cm	Chip board / particle board	0,140	0,129	19,3	19,8	11,7
2	0,1 cm	Stationary air (unventilated)	0,045	0,022	19,4	19,6	0,0
	22,2 cm	Hartfasersteg (Width: 0,8 cm)	0,308	0,721	11,7	18,5	2,5
	3,9 cm	Furnierschichtholzgurt (Width: 4,5 cm)	0,130	0,300	18,5	19,4	1,4
	3,9 cm	Furnierschichtholzgurt (Width: 4,5 cm)	0,130	0,300	10,9	11,7	1,4
3	30 cm	mineral wool 032	0,032	9,375	10,5	19,6	5,8
4	1,8 cm	OSB/3	0,130	0,138	10,4	10,8	11,2
5	0,015 cm	Tyvek® H1	0,230	0,001	10,4	10,5	0,1
6	2,5 cm	Stationary air (unventilated)	0,139	0,180	10,2	10,5	0,0
7	14 cm	solid brick 2000 kg/m3, DIN 105	0,960	0,146	10,0	10,2	280,0
		Thermal contact resistance*		0,040	10,0	10,0	
	50,215 cm	Whole component		9,175			314,0

*Thermal contact resistances according to DIN 6946 for the U-value calculation. Rsi=0,25 and Rse=0,04 according to DIN 4108-3 were used for moisture proofing and temperature profile.

Surface temperature inside (min / average / max):	19,6°C	19,7°C	19,8°C
Surface temperature outside (min / average / max):	10,0°C	10,0°C	10,0°C

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Moisture proofing

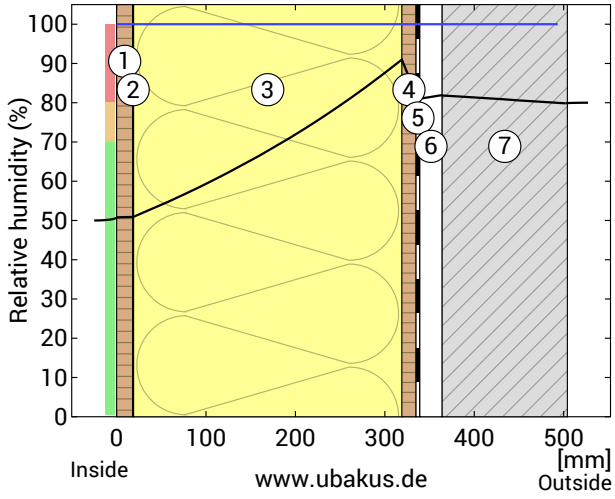
For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 20°C und 50% Humidity; outside: 10°C und 80% Humidity (Climate according to user input).

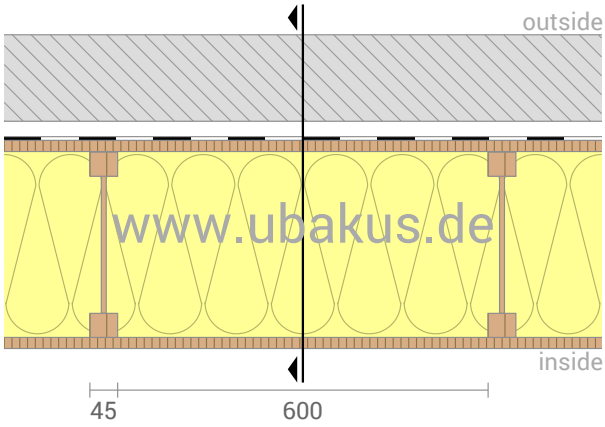
This component is free of condensate under the given climate conditions.

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,8 cm	Chip board / particle board	0,27	-	-	11,7
2	0,1 cm	Stationary air (unventilated)	0,01	-		0,0
	22,2 cm	Hartfasersteg (Width: 0,8 cm)	2,22	-	-	2,5
	3,9 cm	Furnierschichtholzgurt (Width: 4,5 cm)	0,78	-	-	1,4
	3,9 cm	Furnierschichtholzgurt (Width: 4,5 cm)	0,78	-	-	1,4
3	30 cm	mineral wool 032	0,30	-		5,8
4	1,8 cm	OSB/3	5,40	-	-	11,2
5	0,015 cm	Tyvek® H1	0,01	-		0,1
6	2,5 cm	Stationary air (unventilated)	0,01	-		0,0
7	14 cm	solid brick 2000 kg/m3, DIN 105	1,40	-		280,0
	50,215 cm	Whole component	7,48	0		314,0

Humidity

The temperature of the inside surface is 19,6 °C leading to a relative humidity on the surface of 51%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.





① Chip board / particle board (18 mm)
② Stationary air (1 mm)
③ mineral wool 032 (300 mm)
④ OSB/3 (18 mm)
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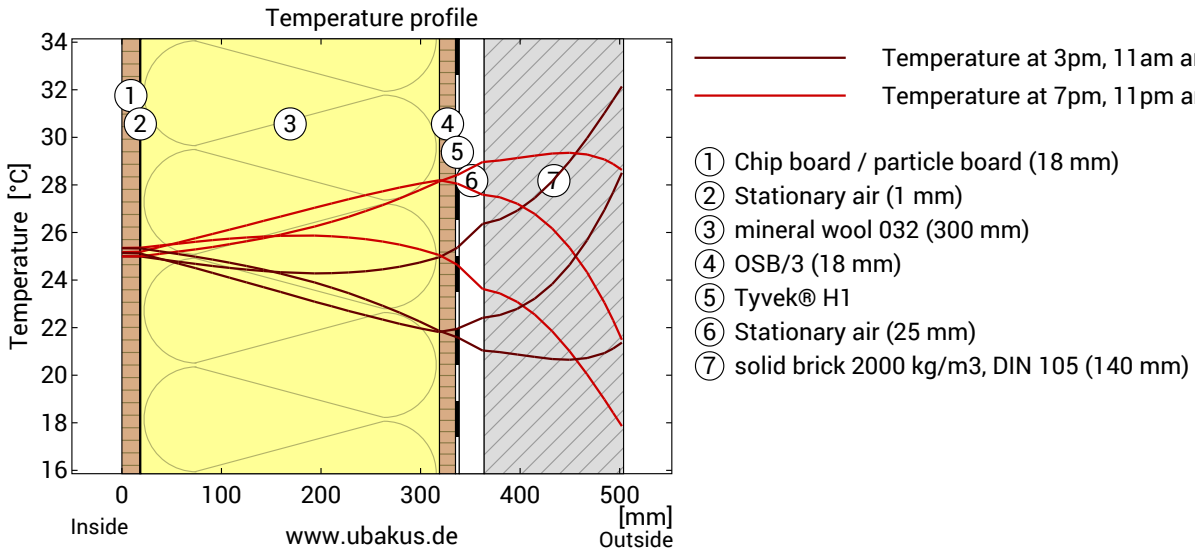
Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

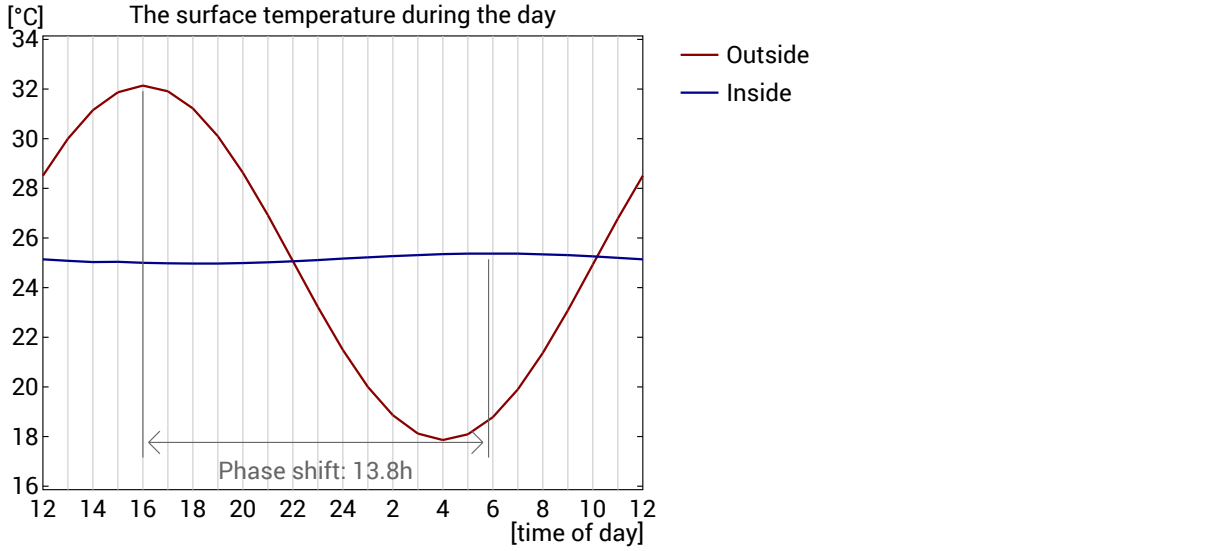
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Heat protection

The following results are properties of the tested component alone and do not make any statement about the heat protection of the entire room:





Top: Temperature profile within the component at different times. From top to bottom, brown lines: at 3 pm, 11 am and 7 am and red lines at 7 pm , 11 pm and 3 am.
Bottom: Temperature on the outer (red) and inner (blue) surface in the course of a day. The arrows indicate the location of the temperature maximum values . The maximum of the inner surface temperature should preferably occur during the second half of the night.

Phase shift*	13,8 h	Heat storage capacity (whole component):	334 kJ/m²K
Amplitude attenuation **	35,0	Thermal capacity of inner layers:	32 kJ/m²K
TAV ***	0,029		

* The phase shift is the time in hours after which the temperature peak of the afternoon reaches the component interior.
** The amplitude attenuation describes the attenuation of the temperature wave when passing through the component. A value of 10 means that the temperature on the outside varies 10x stronger than on the inside, e.g. outside 15-35 °C, inside 24-26 °C.
*** The temperature amplitude ratio TAV is the reciprocal of the attenuation: TAV = 1 / amplitude attenuation

Note: The heat protection of a room is influenced by several factors, but essentially by the direct solar radiation through windows and the total amount of heat storage capacity (including floor, interior walls and furniture). A single component usually has only a very small influence on the heat protection of the room.

The calculations presented above have been created for a 1-dimensional cross-section of the component.

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